**Claims**

1.- Continuous multi-microencapsulation process, by means of in situ interfacial polymerization of biologically active materials characterized in that,

(a) in a first step it is added to an oil phase [that contains optionally at least a biologically active material] a water phase containing a polymerization initiator and optionally, at least a biologically active material; further exists at least one surfactant in at least one of the two mentioned phases, and there exists a biologically active material in at least one of the two phases,

(b) In a second step, it is added [to (a)] a solution or dispersion in water that contains at least one hydrocolloid, this producing a phase inversion and the hydrocolloid begins to be deposited and polymerized on the walls of the new formed drops [consisting in a water in oil emulsion], occurring also a cross-linking of the hydrocolloid polymers, optionally in the presence of cations,

(c) In a third step, it is added [to (b)] a solution or dispersion in water that contains at least one protective colloid, that begins to be deposited on the surface of the drops of water in oil, and to polymerize and cross-link with itself and the hydrocolloid,

(d) In a fourth step, it is added [to (c)] a solution or dispersion in water of a primary surfactant that allows a reduction of the size of the water in oil drops,

(e) In a fifth step, during the process of reduction of size, the partially formed microcapsules are deaglomerated and reaglomerated, happening eventually an enclosure of drops inside bigger drops (multi-microencapsulation),

(f) When enough time has passed in order that the oil [water in oil] drops are covered by at least one hydrocolloid and at least a protective colloid, the temperature is increased in order to strengthen the wall of the mentioned drops; at this time the drops are already microcapsules or multi-microcapsules suspended in water.

(g) Optionally, the formulation is dried for obtaining dust, optionally it is reformulated by means of state of the art techniques to obtain (or to mix the microcapsules with) wettable powders, gels, cosmetic creams or medicinal, bath products, microorganism media; optionally additives are added (optionally antiagglomerating agents) for microcapsules' dried formulations.

(h) All the process –except optionally step (g)- is carried out under continuous agitation.

2.- Process for the preparation of a suspension of microcapsules characterized in that:

(a) Two different solutions (Fig.1) 1a (oil) and 1b (water) are mixed by addition of 1b to 1a, these solutions containing active ingredients and optionally free or sequestered cations to be liberated later,

(b) Thanks to a food emulsifier that can be in 1a or in 1b, an emulsion of water drops (10) into the oil phase (9) is formed. This step is finished with the formation of emulsion 1c, where in the oil phase (9) are solubilized or dispersed –preferably liposoluble- active ingredients; it is also formed an oil in water emulsion, with the water droplets (10) containing –preferably hydrosoluble- active ingredients, being optional that the solubility [of the active ingredients] in water or in oil is modified by derivatization of the active ingredient(s),

(c) Then, it is added to existing emulsion [1c] the solution 2b, having 2b at least one hydrocolloid [able to be polymerized and cross-linked] and optionally containing at least one active ingredient,

(d) It follows a phase inversion, having then dispersed drops (11) that are an emulsion of water (12) in oil, dispersed in the continuous phase (24), namely, water,

(e) when the polymerization and cross-linking reactions are deemed to be finalized, reaching a reduction of particle size to about 1-30 m, the temperature that remained at about 30-70 °C is raised to 60-100 °C.

(f) Finally it is added a food grade viscosity modifier.

(g) Optionally, the formulation may be spray-dried or any state of the art technique, and to be collected to form dry powders, self-emulsifiable powders, gels, creams or any other form that may contain them, including oil dispersions, as well as to be submitted to a liophyllization unit operation.

3.- Process of microencapsulation of biologically active materials, according claims 1 or 2 characterized in that both the hydrocolloid(s) and the protective colloid(s) are added together in the form of an aqueous solution or dispersion, saving the step (d) of claim 1, because the protective colloid is present in the solution described in claim 1 step (c) or claim 2 step (e).

4.- Process of microencapsulation of biologically active materials according claim 1, characterized in that the protective colloid(s) belong to the chemical group of hydrocolloids.

5.- Process of microencapsulation of biologically active materials according claims 1 and 2 characterized in that the hydrocolloid(s) and the protective colloids are preferably chosen among the group of: chitosans, starch, dextrins, cyclodextrins, celluloses, lignin, pectines, agar, alginates, carrageens, gelatins, guar gum, arabic gum, gelatin, tragacanths, lignosulfonates, Caraya gum, Cerationia siliqua gum, saponines, xantan gum, seed gums, galactomanans, arabanogalactams, beta-glucans, inulin, psyllium, acacia gum; in all their isomeric and stereochemical forms, in all their variations regarding quantity and proportion of monomers or oligomers constituting the hydrocolloid, in all presentation forms, as salts of metal cations or nitrogenated, sulfurated or phosphorinated compounds, as well as any derivatization form of the aforementioned hydrocolloids.

6.- Process of microencapsulation of biologically active materials according any preceding claims, characterized in that the primary emulsifier has a hydrophilic – lipophylic balance of 9 to 16, preferably 12 to 14.

7.- Process of microencapsulation of biologically active materials according any preceding claims, characterized in that in the first emulsion formed the oil droplets have a particle size of 50-500 µm, preferably 70-200 µm.

8.- Process of microencapsulation of biologically active materials according any preceding claims, characterized in that the finally formed microcapsules (7b) have a particle size of 0.1-100 µm, preferably 1-30 µm, more preferably 1-5 µm.

9.-Process of microencapsulation of biologically active materials according any preceding claims, characterized in that the formed microcapsules (7b) have a particle size that changes with time by aggregation being the particle size optimum just when the microcapsules' formulation is going to be used.

10.- Process of microencapsulation of biologically active materials according any preceding claims, characterized in that the revolutions per minute of the agitator employed for forming the emulsion(s) and reducing the particle size are in the range 3000-25000, being this value higher at the time of forming the first emulsion and lower when the microcapsules are finally formed, and when is added the viscosity modifier.

11.- Process of microencapsulation of biologically active materials according any preceding claims, characterized in that there are used two types of agitators, one with teeths and the other with anchor.

12.- Process of microencapsulation of biologically active materials according any preceding claims, characterized in that at least one hydrocolloid forming the wall is substituted by a hydrogel, optionally, albumins, alginates, polycarboxilates, poli-L-lactid, starches and derivatives of all of them.

13.- Process of microencapsulation of biologically active materials according any preceding claims, characterized in that the aqueous solution of hydrocolloid contains a binary or ternary mixture of the hydrocolloids selected according to claim 5 and/or hydrogel(s) mentioned in claim 12.

14.- Process of microencapsulation of biologically active materials according any preceding claims, characterized in that the aqueous solution of hydrocolloid contains a binary or ternary mixture of the hydrocolloids selected according to claim 5.

15.- Process of microencapsulation of biologically active materials according any preceding claims, characterized in that the microcapsules or the aqueous phase in that they are disperse, contain compounds that help or stabilize structurally the structure of the microcapsule.

16.- Process of microencapsulation of biologically active materials according any preceding claims, characterized in that the continuous aqueous phase in that the microcapsules are dispersed, contains biologically active materials, that have been added in the form of a dissolution, dispersion or emulsion in any of the solutions of: hydrocolloid(s), protective colloid(s) primary emulsifier(s) being these solutions used according suitable preceding claims.

17.- Process of microencapsulation of biologically active materials according any preceding claims, characterized in that it is carried out in at least one of the following conditions: under vacuum, reduced pressure, in the presence of an inert gas (optionally nitrogen, helium), protected from any wavelength, in sterile conditions.

18.- Process of microencapsulation of biologically active materials according any preceding claims, characterized in that the aqueous solutions or dispersions are substituted by solutions or dispersion: (i) based in aqueous extracts, (ii) with a content in alcohols (with a molecular weight of 144 or less) not higher than 40%, (iii) of compounds soluble or dispersible in water.

19.- Process of microencapsulation of biologically active materials according any preceding claims, characterized in that the oil phase comprises a hydrogenated oil or a wax, eventually honey.

20.- Process of microencapsulation of biologically active materials according any preceding claims, characterized in that the water and/or oil phase act as thermal regulator, stabilizing the microcapsules and biologically active materials contained in the liquid phases (both inside and outside of the microcapsules) against temperature changes, optionally adding compounds to diminish the freezing point or increase the freezing point, being possible to add these compounds to the oil phase to modify the thermal properties of the formulation itself or the microcapsules.

21.- Process of microencapsulation of biologically active materials according any preceding claims, characterized in that in any step of the process is added a microbiological stabilizer to the oil and/or water phases.

22.- Process of microencapsulation of biologically active materials according any preceding claims, characterized in that in any step of the process is added a state of the art microbiological stabilizer for a dry formulation of microcapsules (eventually lyophilized, in dust form, in granular form).

23.- Process of microencapsulation according any suitable combination of the preceding claims, characterized in that after the drying of the microcapsules, these are reformulatied and dispersed in an oil phase or in a gel or in any semi-solid material or ethanolic solution or organic solvent.

24.- Process of microencapsulation of biologically active materials according any preceding claims, characterized in that the resulting microcapsules are used in any foodstuff (solid or liquid or including gases), optionally but not limited to: cereals and derived (optionally muesli, cereals for milk), pastry shop, dairy products, nutritional supplements, sugars and derived (optionally chocolates, sweet, nougats, marzipans), sweet dietary (with low level of calories), in régime foods and for diabetics, oils and derived, milky and derived, eggs, vegetables and vegetables, vegetables, fruits, tubers and derived, eatable shafts, snacks, appetizers, eatable roots (optionally licorice), bay and wild products, preserves of fruits, dry fruits, meats, sausages, fish, shellfish and crustaceans and their preserves, alcoholic and not alcoholic drinks, carbonated drinks or not carbonated, juices, syrups, nectars, spices, condiments, pre-cooked foods, pre-processed foods (frozen mass of bread), pizzas, honey.

25.- Process of microencapsulation according any suitable combination of the preceding claims characterized in that as biologically active materials are choser at least a compound chosen from the group of omega-3 fattay acids, optionally also omea6 and/or omega 9, coming from fish of flax oil and

these omega fatty acids are accompanied optionally by antioxidants –preferably from green tea- and the mricrocapsules produced thereof are used in backery, cookies, muesli or cereal products with high fiber content, being the total content, with respect 100 grams of final product (e.g., a cookie), of omega 3 plus omega 6 (if present) plus omega 9 (if present) about 50 mg to 400 mg.

26.- Process of microencapsulation of biologically active materials according any preceding claims, characterized in that the main purpose of microencapsulation is to prevent the release of undesirable aromas or flavours to the consumer (human or not human), optionally fish aromas and flavours and those derived from other biologically active ingredients.

27.- Microcapsules produced by a continuous process of microencapsulation, characterized in that (a) contain biologically active materials (b) the microcapsules wall is made by a mixture of at least two hydrocolloids (including hydrogels as particular case of hydrocolloids), such mixture polymerized and cross-linked, (c) the polymerization and cross-linking grade and the nature of hydrocolloids influence the release rate and the protection against oxygen and/or light and/or temperature, (d) the microcapsules have in their core an emulsion water in oil, existing optionally biologically active materials in the oil phase, optionally in the water phases and optionally in all continuous phases, and moreover, the core of the microcapsules may contain smaller microcapsules (multi-microencapsulation possible at least to five degrees), (e) the mean particle size measured with a Master Sizer type laser equipment is 0.1-100 µm, preferably 1-10 µm (f) they are produced by a continuous process of multi-microencapsulation process by interfacial in-situ polymerization process.

28.- Microcapsules produced according any of the preceding claims where the biologically active materials are released by at least a factor belonging to the group: pH, temperature, pressure, ionic force, osmosis, volatilization, presence of compounds that dissolve the microcapsules wall (eventually enzymes or chemical compounds).

29.- Formulation of microcapsules according any appropriate combination of the preceding claims characterized in that it resists usual industrial unit operations regarding microorganisms' control, noxious microorganisms and/or not desired in the final formulation freshly done or possible colonizer microorganisms of the formulation or foodstuff to which the formulation is to be added being this unit operations eventually: sterilization, microbiological stabilization, pasteurization, UHT, ozonization, UV or gamma ray treatment, chemical antimicrobial agents.

30.- Microcapsules according any appropriate combination of the preceding claims characterized in that they are used for providing anabolites and/or nutrients in microbiological cultures in a constant or quasi-constant rate.

31.- Microcapsules according any appropriate combination of the preceding claims characterized in that they are used for providing anabolites and/or nutrients in microbiological cultures, and at least an active ingredient is liberated at certain media pH.

32.- Microcapsules according any appropriate combination of the preceding claims characterized in that they are used for providing anabolites and/or nutrients in microbiological cultures, and at least an active ingredient is liberated at certain media concentration of at least one enzyme.

33.- Microcapsules according any appropriate combination of the preceding claims characterized in that they are used for providing anabolites and/or nutrients in microbiological cultures, and at least an active ingredient is liberated at certain concentration of a chemical, preferably ethanol, that provokes the liberation of the biologically active ingredient.

34.- Microcapsules according any appropriate combination of the preceding claims characterized in that they are used for providing beneficial for the health materials and the microcapsules are added to natural or synthetic sweeteners, salt, pepper, spices and other condiments, in such a way that the addition of such condiments to other foodstuffs increment the nutritive value or the health benefit of such foodstuffs.

35.- Microcapsules according any appropriate combination of the preceding claims characterized in that they contain an UV- protector and/or blocker and/or stabilizer.

36.- Formulation of microcapsules according to any appropriate combination of the preceding claims because the active ingredients are chosen from the group: green tea, black tea, cocoa, red wine or grapes or marcs, cider, apple juice or apple, cereal germ or bran, carrots, chili, allium, horseradish (in particular spicy horseradish).

37.- Process of microencapsulation of biologically active materials beneficial for the human or other animals' health, according to any suitable combination of the preceding claims, characterized in that at least one of the biologically active compound present in the formulation is preferably chosen from the groups:

(a) Flavonoids in general and derivatives: anthocyianidins, pro-anthocyanidins, oligomer-procyanidine, isoflavones, chalcones, catechin, epihatechin, epicatechin gallate, epigallocatechin, epigallocatechin gallate, eriocitrin, narirutin, rutin, naringin, myricitrin, hesperidin, myricetin, eriodictyol, fisetin, quercetin, naringenin, luteolin, hesperitin, kaempferol, isorhamnetin, apigenin, rhamnetin, galangin, quercitrin, quercetin, diosmetin, taxifolin, galandin, biochanin A, genistein, eriodictyol, chrysin, hydroxytyrosol, oleuropein, glabridine, licochalcone, daidzein, matairesinol, secoisolariciresinol, enterodiol, enterolactone, equol, desmethylangolensin, luteoferol, luteolinidin, apiferol, apigenidin, leucocyanidin, taxifolin, pelargonidin; and derivatives thereof;

(b) phenolic acids in general and derivatives (preferably esters, glycosides, rutinosides and amines): gallic, sinapic, syringic, caffeic, chlorogenic, ferulic, (o-, m- or p-) coumaric, guaiacol, (o-, m- or p-) cresol, 4-ethylphenol, 4-vinylguaicol, eugenol, p-hydroxybenzoic, procatechuic,

vanillic, hydroxycinnamic, tanins in general tannins, ellagiotannins, gallotannins; and derivatives thereof;

(c) esctructurally combined amides comprising hydroxycinnamic acids and anthranilic acids (avenanthramides), avenasterol, hydroxycinnamic acids and long-chain fatty acids or alcohols –and derivatives thereof-; indoleamines (e.g. melatonin); inulin, glutation;

(d) terpenoids in general and derivatives, monoterpenes, diterpenes, sesquiterpenes, triterpenes, tetraterpenes including the carotenoids: alfa-carotene, phytoene, cyclo-artenol, beta-carotene, ionone, zeaxanthin, capsanthin, astaxanthin, canthaxantin, violaxanthin, mutatoxanthin, luteoxanthin, auroxanthin, neoxanthin, apo-carotinal, xanthophylls; and derivatives thereof;

(e) commonly synthesized antioxidants for its use in foodstuffs and derivatives of the type of butylhydroxyanisol, 2,6-di-tert-butylhydroxytoluene, tert-butylhydroquinone, 2,6-di-tert-butylhydroquinone, 2,6-diterbutyl-4-hydroxymethylphenol, 2,4,5-trihidroxibutyrophenone; and derivatives thereof, tocopherols (e.g. alpha, beta, gamma and delta tocopherols –and derivatives thereof-; Tocotrienols (alpha, beta, gamma and delta tocotrienols –and derivatives thereof-); Tocochromanols;

(f) alpha-lipoic acid; coenzime Q-10; vitamins; aminoacids (preferably L-arginine, cistina and cisteine) and their corresponding organic polymers like oligopeptides, peptides –preferably carnosine, carnitine, glutathion-; enzymes; enzyme inhibitors (preferably phenolases or oxigenases or lipooxigenasas or lipases inhibitors;

(g) minerals and oligoelements, especially those involved in redox processes in vivo like selenium, zinc, magnesium;

38.- Process of microencapsulation of biologically active materials according to any suitable combination of the preceding claims, characterized in that at least one of the biologically active compounds present in the formulation preferably has its origin in: Medicago sativa, Pimenal officinalis, Hibiscus abelmoschus, Angelica archangelica, Galipea officinalis, Pimpinella anisum, Ferula foetida, Ferula asafetida, Melissa officinalis, Myroxylon pereirae, Ocimum basilicum, Pimenta acris, Citrus aurantium bergamia, Prunus amygdalus, Citrus aurantium, Citrus aurantium amara, Piper nigrum, Prunus spinosa, Aniba rosaeodora, Camelia oleifera, Camelia sinensis, Carum carvi, Elettaria cardamomum, Ceratonia siliqua, Daucus carota, Dacus carota sativa, Cascarilla, Apium graveolens, Anthemis nobilis, Matricaria chamomilla, Anthemis nobilis, Anthriscus cerefolium, Cichorium intybus, Cinnamomum spp., Cinnamomum zeylanicum, Cymbopogon nardus, Salvia sclarea, Trifolium pratense, Theobroma cacao, Coffea arabica, Coriandrium sativum, Cuminum cyminum, Taraxacum officinale, Sambucus nigra, Edelweiss, Helichrysum italicum, Foeniculum vulgare, Trigonella foenumgraecum, Arabidopsis spp., Zingiber officinale, Citrus grandis, Psidium guajava, Humulus lupus, Marrubium vulgare, Monarda punctata, Hyssopus officinals, Jasminum officinale, Jasminum grandiflorum, Juniperus spp. Juniperus comunis, Eucaliptus officinalis, Cola acuminata, Laurus nobilis, Lavandula spp. Lavandula hybrida, Taxus baccata, Citrus medica limonum, Myristica fragans, Marjorana hortensis, Thymus spp., Thymus officinalis, Thymus mastichina, Ilex paraguarensis, Chamomilla recutita, Saccharum officinarum, Myristica fragans, Allium cepa, Citrus aurantium dulcis, Carum petroselinum, Mentha pulegium, Mentha piperita, Pimenta officinalis, Chimaphila umbellate,

Punica granatum, Pelargonium spp., Pelargonium graveolens, Rosmarinus officinalis, Crocus sativus, Salvia app., Salvia officinalis, Mentha spicata, Mentha viridis, Satureia hortensis, Satureja hortensis, Origanum majorana, Tamarindus indica, Citrus reticulata, Artemisia dracunculus, Thea sinensis, Thymus vulgaris, Polianthes tuberosa, Curcuma longa, Prunus serotina, Thymus serpillum, Satureja Montana, Cananga odorata, Curcuma zedoaria, Plantago major, Adansonia digitata, Ananas comosus, Artocarpus altilis, Carica papaya, Lycopersicon esculentum, Cephalophus spp., Vaccinium myrtillus, Thymus aragonensis, Thymus spp., Citrus aurantiifolia, Citrus paradisi, Cucumis melo, Cucurbita spp., Vitis spp., Vitis vinifera, Mangifera indica, Lamiaceae (Coleus, Hedeoma, Hyptis, Leonurus, Leucas, Lycopus, Marrubium, Mentha, Monarda, Perilla, Prunella, Salvia, Stachys, Teucrium, Thymus), Cannabis spp., Digitalis lanata, Adonis vernalis, Aesculus hippocastanum, Frazinus rhychophylla, Agrimonia supatoria, Rauvolfia sepentina, Andrographis paniculata, Areca catechu, Atropa belladonna, Berberis vulgaris, Ardisia japonica, Betula alba, Ananas comosus, Camellia sinensis, Cinnamomum camphora, Camptotheca acuminata, Potentilla fragarioides, Erythroxylum coca, Papaver somniferum, Colchicum autumnale, Claviceps purpurea, Digitalis purpurea, Digitalis lanata, Glaucium flavum, Papaver somniferum, Gossypium spp., Hyoscyamus niger, Camptotheca acuminata, Piper methysticum, Lobelia inflata, Crotalaria sessiliflora, Nicotiana tabacum, Physostigma venenosum, Ephedra sinica, Cinchona ledgeriana, Rhododendron molle, Datura spp., Taxus brevifolia, Strychnos nux-vomica, Stevia rebaudiana, Theobroma cacao, Valeriana officinalis, Pausinystalia yohimbe, Ephedra spp. Crataegus oxyacantha, Hamamelis virginiana, Hydrastis Canadensis, Hypericum perforatum, Potentilla erectra, Ledum palustre, Salvia officinalis, Chamomilla recutita, Arctostaphylos uva, Eucommia ulmoides, Mytilus galloprovincialis, Diplazium esculentum, Manihot utilissima, Sauropous androgynus, Terminalia arjuna, Iberis amara, Crataegus spp., Arbutus unedo, Cynara scolymus, Amaranthus caudatus, Alchornea laxiflora, Alpinia officinarum, Xanthophyllomyces dendrorhous, Crataegus monogyna, Taxus yunnanensis, Bacopa monniera, Cistus albidus, Ocimum basilicum, Rosmarinus officinalis, Thymus vulgaris, Bixa orellana, Centella asiatica, Urtica dioica, Agrocybe aegerita, Crataegus laevigata, Satureja hortensis, Crocus sativus, Coccinia indica, Brugia malayi, Rubus spp., Silybum marianum, Cannabis spp., Cannabis sativa, Hypericum perforatum, Rhus coriaria, Olea europaea, Cyclopia intermedia, Ginkgo biloba, Lentinus lepideus, Pseudomonas putida, Sargassum micracanthum, Pinus radiata, Pinus sp., Phaseoulus mungo, Cicer arietinum, Vigna sinensis, Phaseolus aureus, Dolichos lablab, Cajanus cajan, Vicia faba, Dolichos biflorus, Phaseolus lunatus, Phaseolus aconitifolius, Pisum sativum, Psophocarpus tetragonolobus, Arachis hypoagea, Brassica spp., Brassica campestris, Brassica napus, Valeriana officinalis, Echinacea purpurea, Echinacea pallida, Echinacea angustifolia, Glcyrrhiza glabra, Seronea repens, Vaccinium macrocarpon, Tancetum parthenuum, Tancetum parthenuum, Vaccinium macrocarpon, cereals, seed fruits, silvestre bays, leguminosae, green tea, black tea and microorganisms able to produce long-chained unsaturated fatty acids.

39.- Process of microencapsulation of biologically active materials according to any suitable combination of the preceding claims, characterized in that at least one of the biologically active materials consist in probiotic bacteria.

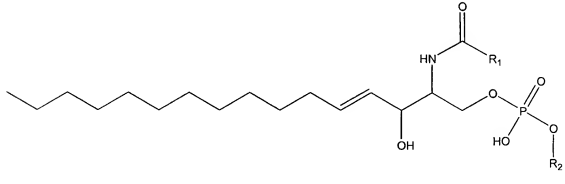
40.- Process of microencapsulation of biologically active materials according to any suitable combination of the preceding claims, characterized in that at least one of the biologically active materials present in the formulation consist in probiotic bacteria, optionally acid lactic-bacteria and more preferably chosen among the group: Lactobacillus casei., L. acidophillus, L. rhamnosus, L. paracasei, L. gasseri, L. fermentum, L. plantarum, L. salivarius, L. crispatus, L. bulgaricus, L. fermentum, L. reuteri, Bifidobacterium infantis, B. bifidum, Streptococcus termophilus, S. bovis, Enterococcus durans, E. faecalis, E. Gallinarum, Escherichia coli, Propionibacterium freudenreicheii, or bacteria or fungi or yeasts genetically modified in that the beneficial genes -characterizing the beneficial properties of probiotic bacteria- have been inserted.

41.- Process of microencapsulation of biologically active materials according to any suitable combination of the preceding claims, characterized in that at least one of the biologically active materials present in the formulation consist in probiotic yeasts, preferably chosen from the group: *Saccharomyces cerevisiae, Kluyveromices marxianus, Rhodotorula rubra, Sporobolomyces puniceus, Aureobasidium pullulans, Leucosporidium scottl.*

42.- Process of microencapsulation of biologically active materials according to any suitable combination of the preceding claims, characterized in that at least one of the biologically active materials present in the formulation consist in probiotic fungi, preferably those fungi present in or coincident or coming from cheeses.

43.- Process of microencapsulation of biologically active materials according to any suitable combination of the preceding claims, characterized in that at least one of the biologically active materials is chosen among the group of compounds represented by the molecular structures (A) and (B) in all their stereochemical and isomeric variations:

Compound(s) A

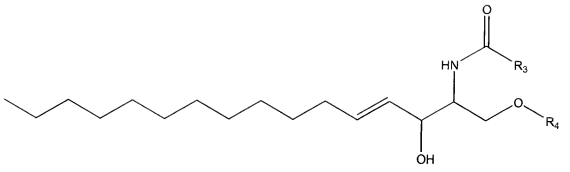



wherein,

$R_1$ is an omega-3 or omega-6 fatty acid esterified

$R_2$ is an omega-3 or omega-6 fatty acid esterified

Compound(s) B




wherein,

$R_3$ is an omega-3 or omega-6 fatty acid esterified

$R_4$ is an omega-3 or omega-6 fatty acid esterified

44.- Process of microencapsulation of biologically active materials according to any suitable combination of the preceding claims, characterized in that at least one of the biologically active materials consists preferably in at least one unsaturated long-chain fatty acid (at least 6 Carbon atoms), in any isomeric and/or stereochemical configuration, as well as any derivatives thereof (preferably esters, ethers, glycerides, phospholipids, sphingolipids, and more preferably, diglycerides, triglycerides, phospholipids or compounds A and/or B): steradionic, eicosapentaenoic, docosahexaenoic, docosapentaenoic, linoleic and conjugated linoleic acids, linolenic, gamma-linolenic, alfa-linoleic, dihomogamma-linolenic, arachidonic, oleic acid.

45.- Process of microencapsulation of biologically active materials according to any suitable combination of the preceding claims, characterized in that the fatty acids are chosen preferably from the group of acids: oleic, steradionic, eicosapentaneoic, docosahexaenoic, linoleic, conjugated linoleic, gamma-linolenic, alfa-linolenic, dihomogamma-linolenic, arachidonic.

46.- Process of microencapsulation of biologically active materials according to any suitable combination of the preceding claims, characterized in that at least one of the biologically active materials consists preferably in at least one unsaturated long-chain fatty acid (of at least 6 Carbon atoms) that are preferably conjugated, keeping or not keeping all or part the unsaturated bonds unchanged with respect the natural compounds, and/or bound covalently with glycerides –more preferably with monoglycerides, diglycerides, triglycerides' esters-, phospholipids, sphingolipids, myelin, amines, amides, ethers, sugars, oligosaccharides, polysaccharides, nitrogenated-, phospororated-, oxygenated-, sulfurated- heterocycles, substituted aromatic rings.

47.- Process of microencapsulation of biologically active materials according to any suitable combination of the preceding claims, characterized in that the unsaturated long-chain fatty acid (of at least 6 Carbon atoms) are selected by its medicinal virtues.

48.- Process of microencapsulation of biologically active materials according to any suitable combination of the preceding claims, characterized in that the unsaturated long-chain fatty acid (of at least 6 Carbon atoms) come from the following natural sources or from genetically modify organisms of the following natural sources, preferably from:

(a) vegetable origin: Boraginaceae, (Borago spp., Borago officinalis); Linaceae (Linum usitatissimum, Linum arvense, Linum sativum); Onograceae (Oenothera biennis); Grossulariaceae (Ribes nigrum), Zea Mais, Gossypium hirsutum, Carthamus tinctorius, Glycine max.

(b) algae preferably: Graciliariceae (Gracilaria spp); Gigartinaceae (Iridaea spp.); Kallymeniaceae (Callopyllis variegata); Durvillaceae (Durvillaea antartica); Solieriaceae (Euchema cottoni); Gelidiaceae (Gelidium spp); Lossoniaceae (Lesonia nigrescens); Gigantinaceae (Gigartina spp.); Lessoniaceae (Macrocystis spp.); Bangiaceae (Porphyra spp.); Crypthecodinium spp.

(c) Animal origin, normally fish oil, preferably: Engaulidae (Lycengraulis olidus); Clupeidae (Sardina pilchardus); Scomberesocidae (Scomberesox saurus scombroides); Berycidae (Beryx splendens); Engraulidae (Engraulis ringens); Ophichthyidae (Ophichthus spp.); Serranidae (Hemilutjanus macrophthalmus); Scombridae (Thunnus spp., en especial, Thunnus albacares, Thunnus alalunga, Thunnus obesus); Sciaenidae (Cynoscion analis); Carcharhinidae (Prionace glauca); Normanichthyidae (Normanichthys crockeri); Percichthyidae (Polyprion oxygeneios); Nototheniidae (Dissostichus eleginoides); Apogonidae (Epigonus crassicaudus); Branchiostegidae (Prolatilus jugularis); Scombridae (Thunnus spp., Thunnus albacares, Thunnus alalunga, Thunnus obesus, Sarda spp., Sarda chiliensis, Scomber japonicus peruanus), Sciaenidae (Cynoscion analis), Carcharhinidae, Normanichthyidae (Normanichthys crockeri); Percichthyidae (Polyprion oxygeneios); Nototheniidae (Bacalao de profundidad); Apogonidae (Epigonus crassicaudus); Branchiostegidae (Prolatilus jugularis); Cheilodactylidae (Cheilodactylus gayi); Gadidae (Salilota australis); Pomadasyidae; Scorpaenidae; Serranidae; Cyprinidae; Monacanthidae; Centrolophidae; Ophidiidae; Scorpaenidae; Coryphaenidae; Channichthydae; Sciaenidae; Aplodactylidae; Carangidae (Trachurus symetricus murphyi); Bothidae (Paralichthys microps); Mugilidae; Clupeidae; Priacathidae; Merlucciidae (Merluccius gayi gayi, Merluccius australis); Macruronidae (Macruronus magellanicus); Gadidae (Micromesistius australis); Girellidae; Trachichthyidae; Carangidae; Kyphosidae; Callorhynchidae; Labridae ; Macrouridae; Atherinidae; Gobiesocidae; Alopiidae; Galaxiidae; Rajidae; Bramidae; Carangidae; Nototheniidae; Scianidae; Mugiloididae; Salmonidae (Salmo spp., Salmo salar, Oncorhynchus spp., Oncorhynchus kisutch, Oncorhynchus mykiss, Oncorhynchus tshawytscha); Clupeidae (Sardinops spp., Sardinops sagax, Clupea bentincki); Pomadasyidae; Gempylidae; Lamnidae (Isurus spp., Isurus oxyrinchus);Triakidae; Clinidae; Scophthalmidae; Labridae; and more preferably Atlantic mackerel, Engraulis encrasicholus, Pomatomus saltatrix, Sarda sarda, Sardina pilchardus, Brevoortia tyrannus, Brevoortia patronus, Chloroscombrus chrysurus, Auxis thazard, Scomber scombrus, Scomber japonicus, Alosa aestivalis, Clupea harengus, Etrumeus teres, Argentina silus, Ictalurus punctatus.

(d) microbial origin, preferably: Saccharomices cerevisiae, Escherichia coli, Schizochytrium spp., Thraustochytrium aureum, Thraustochytrium roseum, Thraustochytrium striatum, Mortiriella spp.,

Phytium spp., Aspergillus spp. Aspergillus nidulans, Aspergillus sydowi, Fusarium spp., Fusarium equiseti, Fusarium oxysporum.

49.- Process of microencapsulation of biologically active materials according to any suitable combination of the preceding claims, characterized in that the unsaturated fatty acids omega-3 and/or omega-6 and/or omega 9 that are incorporated in the claim 1 or 2, come from commercial products to be incorporated in foodstuffs, based on fish or vegetable or microbial oils or mixes thereof.

50.- Process of microencapsulation of biologically active materials according to any suitable combination of the preceding claims, characterized in that the compounds omega-3, omega-6, cerebrosides, and optionally omega-9, are combined to improve the development or maintenance or recovery of the brain cortex.

51.- Formulation consisting in a suspension of microcapsules produced according to any suitable combination of the preceding claims, characterized in that contains as active compound, or as an additional active compound, linoleic acid, conjugated linoleic acid, arachidonic acid, docosaexenoic acid, eicosapentenoic acid, steradionic acid, alfa-linolenic acid, dihomogammalinolenic acid, oleic acid, linolenic acid, in all their isomeric and/or stereochemical configurations.

52.- Formulation of microcapsules to be used for the neuronal development, specially the brain, and more specially in foetus, new born, babies and children characterized in that there exists at least one compound defined by the formulas (A) and/or (B).

53.- Formulation of microcapsules to be used for the development of potential intelligence in foetus and breast feeding babies –through the maternal ingestion of a suitable alimentary vehicle in which the formulation of microcapsules is added- and in formulations of milk for babies and children, according the preceding claims, characterized in that contains omega-3 and omega-6 fatty acids in a ratio 0.5 – 10.0, preferably 1.4 – 5.7 and contains cerebrosides in a percentage of 0,005% - 1% and/or optionally compounds (A) and/or (B), also optionally omega-9 fatty acids.

54.- Formulation of microcapsules for its use in infant formula according to any suitable combination of preceding claims, characterized in that no omega-6 fatty acid is added and independently and optionally gamma-linolenic acid is added in a percentage of 1.25%.

55.- Formulation of microcapsules used to increase the development of the brain cortex and intelligence, characterized in that it contains omega-3 and omega-6 fatty acids, preferably in a ratio of 0.5-10 preferably 1.4 – 5.7 and contains also cerebrosides in a percentage of 0.005% - 1% and optionally compounds (A) and/or (B).

56.- Beverage containing a formulation of microcapsules, produced according to any suitable combination of the preceding claims, characterized in that the beverage contains microcapsules, and

the latter contain in the oil phase omega-6 and/or omega-3 fatty acids, optionally with antioxidants added in the aqueous phases of the microcapsule or in the oil phase of the microcapsule or in both and the beverage contains additionally flavours or extracts of: grape, pineapple, and at least a citric fruit, preferably selected from tangerine, orange, mandarin, lemon, lime, and the omega-3 and omega-6 fatty acids remain stable in the beverage after the industrial process, including customary microbiological stabilization processes like pasteurization, at least up to one month, with a loss of omega-3 less than 7%.

57.- Microcapsules produced according to any suitable combination of the preceding claims, characterized in that the are stable (no opening of the microcapsule's wall) at pH higher than 3.5.

58.- Microcapsules produced according to any suitable combination of the preceding claims characterized in that the microcapsules' wall (and subsequent liberation of the content) occurs quickly at pH lower than 3.

59.- Microcapsules formed according to the process described in claim 1, characterized in that the breakdown of the microcapsules' wall and the liberation of the content occur in the conditions of the human stomach by virtue of lowering the pH.

60.- Microcapsules formed according to the process described in claim 1, characterized in that the breakdown of the microcapsules' wall and the liberation of the content occur in the conditions of the human stomach by enzimatic digestion.

61.- Microcapsules formed according to the process described in claim 1, characterized in that the breakdown of the microcapsules' wall and the liberation of the content occurs in the conditions of animals' stomach, being the microcapsule's wall materials adequately chosen for the pH range of the stomach of the animal or its ability of enzyme digestion.

62.- Microcapsules suitable for their ingestion, containing ingredients of the type omega-3 and/or omega-6 and/or omega-9 and/or sphingolipids, produced according any suitable combination of the preceding claims characterized in that the microcapsules are included in an infant formulation in a proportion according to the national or international public medical recommendations, stabilized with vitamin E and/or vitamin C, as well derivatives of both vitamins (specially those derivatives that influence the lipophylic or hydrophilic character).

63.- Microcapsules according any suitable combination of the preceding claims characterized in that the active ingredients are hormones.

64.- Microcapsules according any suitable combination of the preceding claims characterized in that the hydrocolloids and protective colloids are chosen according the pH range of the animal's stomach, considering that animals of the same genus and species have the same pH range.

65.- Microcapsules according any suitable combination of the preceding claims characterized in that the hydrocolloids and protective colloids are chosen according the pH range of the animal's stomach, including the human, considering that animals of the same genus and species have the same pH range, being released at least one active compound in the stomach.

66.- Microcapsules according any suitable combination of preceding claims characterized in that are used in acid foodstuffs preferably yogurts, juices, soft drinks.

67.- Microcapsules according any suitable combination of preceding claims characterized in that the breakdown of the microcapsule's wall occurs at least because the attack of at least one enzyme, eventually activated at a certain pH.

68.- Microcapsules according any suitable combination of preceding claims characterized in that the breakdown of the microcapsule's wall, totally or partly, is produced because of enzyme(s), eventually by the pH, present in the animal's mouth, including the human.

69.- Formulation of microcapsules for its use in infant formula according to any suitable combination of the preceding claims, characterized in that all the active ingredients and optionally all components of the formulation have been produced by biological and/or ecological agriculture, including the term agriculture fisheries and farming.

70.- Formulation of microcapsules for its use in infant formula according to any suitable combination of the preceding claims, characterized in that for obtaining the active ingredient(s) have been used genetically modified organisms, hybrid vegetable varieties or obtained by human selection, as well as microbiological cultures obtained by any means.

71.- Microcapsules according any suitable combination of the preceding claims characterized in that they are used in foodstuffs for animals, especially cattle, aviculture, fisheries and pets.

72.- Microcapsules according any suitable combination of the preceding claims characterized in that they are used in medicinal formulas, being combined with active ingredients not present in the microcapsules or being the active ingredients present in the microcapsules or formulation of microcapsules the unique active ingredients of the medicinal formula, including under the term medicinal formula materials used for contrast in radiology, seed for radiotherapy, thermotherapy or therapy with light of any wavelength.

73.- Microcapsules according any suitable combination of the preceding claims characterized in that they are added to para-pharmaceutic products of any composition, being the active ingredients of the microcapsules present in any concentration in the para-pharmaceutic product.

74.- Alimentary formulation containing microcapsules formed with edible materials containing active ingredients suitable for alimentary use, characterized in that the microcapsules are added to the alimentary formulation (any type of foodstuff or nutritional supplement) just at the time of consumption, thanks to a physical separation in between the microcapsules and the foodstuff that is eliminated at the time of consumption.

75.- Alimentary formulation containing microcapsules, the latter containing active ingredients, characterized in that the microcapsules are added to the alimentary formulation just at the time of consumption, by means of a physical separation during the shelf storage of the alimentary formulation of the microcapsules and the rest of the alimentary formulation by means of a barrier of membrane; being produced the addition of the microcapsules to the alimentary formulation by breakdown of said barrier or membrane in the previous moment before consumption or in a suitable time frame to allow a correct dispersion of the microcapsules in the alimentary formulation; in the case of beverages those microcapsules are preferably enclosed in a receptacle and are dispersed into the beverage by means of externally applied pressure on the receptacle and breakdown of the membrane that separates the microcapsules from the beverage, preferably being that receptacle present in the cap of the beverage container.

76.- Microcapsules according any suitable combination of the preceding claims characterized in that the microcapsule's wall material(s) are dissolved or degraded or liberate the active materials when the microcapsules are in the mouth of the consumer (human or other animals), being the consumer able to appreciate the organoleptic qualities of at least one microencapsulated material.

77.- Microcapsules produced according claim 51 characterized in that at least one of the hydrocolloids present in the wall or the unique compound of the wall is a hydrogel or a polymer highly soluble and/or gelificable with the moisture present in the mouth of the consumer (being human or other animal).

78.- Formulation of microcapsules for its use in infant formula according to any suitable combination of the preceding claims, characterized in that all the materials used and present in the final formulation of the microcapsules are approved alimentary use or edible.

79.- Formulation of microcapsules for its use in infant formula according to any suitable combination of the preceding claims, characterized in that all the materials used and present in the final formulation of the microcapsules are approved alimentary use, being the latter considered according to the legislation corresponding to the Country or Region where the formulation of microcapsules are produced and/or consumed.

80.- Juice containing microcapsules produced according any suitable combination of the preceding claims characterized in that (a) the microcapsules contain omega-3 fatty acids coming from a commercial formulation of edible linseed oil; (b) the oil phase contains the linseed oil and an emulsifier based on soja compounds; (c) the water phase contains a mix of different subclasses of hydrocolloids

of the type alginates and/or Arabic gum and/or kappa-carrageenate and/or guar gum, also an edible primary emulsifier with HLB in between 10 and 14 and an edible viscosity modifier; (d) the pH of the formulation of microcapsules is 3 to 6, the particle size median of the freshly produced microcapsules is 1 – 10 µm; (e) the main ingredient of the juice is orange juice.

81.- Juice according claim 80 characterized in that the fruits are selected from citric fruits, pineapple, grape.

82.- Juice according claims 83 and 84 characterized in that contains (referred to 150 mL of juice) omega-3 in the range 20-200 mg, omega-6 in the range 10-100 mg and omega-9 in the range 5-50 mg; with a ratio of omega-3 to omega-6 of about 3 to 1.

83.- Formulation consisting in a dispersion of microcapsules according any suitable combination of the preceding claims, characterized in that the active ingredients that are easily oxidable, in particular the unsaturated fatty acids, are protected by means of other active ingredients that can be defined by determined chemical structures or being extracts or juices with antioxidant properties, being the antioxidants, independently from their hydrophobicity in the water phase or in the oil phase, preferably in the phase where the easily oxidable material is present.